

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1-15 (deleted)

16. (new): A computer-implemented method of finding a solution for a problem comprising:
representing a population of individuals as chromosomes, each said chromosome including at least one gene, said gene further including a head consisting of symbols representing functions and a tail consisting of symbols representing arguments;
creating a sub-expression tree each for each of said at least one gene, the sub-expression tree including a hierarchical arrangement of the symbols;
creating an expression tree for each of the chromosomes, the expression tree including the sub-expression trees linked by a function.
performing a series of iteration steps to produce the solution for the problem, each iteration step further comprising;
executing each of the expression trees against a set of fitness cases to produce a set of results, said results being a measure of a fitness of a corresponding individual to solve the problem;
assigning each of said results to the corresponding expression tree;

selecting the individuals based on the results with individuals having a higher fitness being selected at a higher probability;

adding descendants of the selected individuals to the population, the descendants being generated proportional to the fitness and said descendants being identical to the corresponding individuals; and

executing one or more of mutation, transposition, insertion, gene transposition, one-point recombination or two-point recombination.

17. (new): The computer-implemented method of claim 16, wherein during mutation, the corresponding descendant is modified by changing at least one said symbol of a chromosome corresponding to the descendant for another without disrupting the structural and functional organization of a head and a tail of a corresponding gene producing a new descendant which is added to the population.

18. (new): The computer-implemented method of claim 16, wherein during transposition, a corresponding descendant is modified by intra-chromosomal transposition of transposition elements randomly chosen among symbols of a head of a corresponding chromosome to a start of a randomly chosen gene of the corresponding chromosome without disrupting a structural and functional organization of said head and said tail of said chosen gene producing a new descendant which is added to the population.

19. (new): The computer-implemented method of claim 16, wherein during insertion, a corresponding descendant is modified by intra-chromosomal insertion of insertion elements randomly chosen among symbols of a corresponding chromosome to a head of a randomly chosen gene without disrupting the structural and functional organization of said head and a tail of said chosen gene producing a new descendant which is added to the population.

20. (new): The computer-implemented method of claim 16, wherein during gene transposition, a corresponding descendant is modified by intra-chromosomal transposition of a randomly chosen entire gene to start of a corresponding chromosome producing a new descendant which is added to the population.

21. (new): The computer-implemented method of claim 16, wherein during one-point recombination, at least two chromosomes are randomly chosen and paired to be modified by exchanging material downstream a recombination point of the chosen chromosomes producing two new descendants which are added to the population.

22. (new): The computer-implemented method of claim 16, wherein during two-point recombination, at least two corresponding chromosomes are randomly chosen and paired to be modified by exchanging an entire gene producing two new descendants which are added to the population.

23. (new): The computer-implemented method of claim 16, wherein said selection step further comprises a selection scheme that selects individuals according to said fitness .

24. (new): The computer-implemented method of claim 16, further comprising a selection and replication step wherein the individual with said higher fitness is selected and replicated forming a new descendant.

25. (new): The computer-implemented method of claim 16, wherein an individual of said population having a pre-established value of fitness is designated as the solution to the problem.

26. (new): The computer-implemented method of claim 16, wherein the initial population of individuals is randomly generated creating chromosomes composed of one or more genes composed of a head containing symbols that represent functions and arguments and a tail containing symbols representing arguments.

27. (new): A computer programming product, including computer readable media, said media comprising instruction to enable a computer to perform a following procedure:

representing a population of individuals as chromosomes, each said chromosome including at least one gene, said gene further including a head consisting of symbols representing functions and a tail consisting of symbols representing arguments;

creating a sub-expression tree each for each of said at least one gene, the sub-expression tree including a hierarchical arrangement of the symbols;

creating an expression tree for each of the chromosomes, the expression tree including the sub-expression trees linked by a function;

performing a series of iteration steps to produce the solution for the problem, each iteration step further comprising;

executing each of the expression trees against a set of fitness cases to produce a set of results, said results being a measure of a fitness of a corresponding individual to solve the problem;

assigning each of said results to the corresponding expression tree;

selecting the individuals based on the results with individuals having a higher fitness being selected at a higher probability;

adding descendants of the selected individuals to the population, the descendants being generated proportional to the fitness and said descendants being identical to the corresponding individuals; and

executing one or more of mutation, transposition, insertion, gene transposition, one-point recombination or two-point recombination.

28. (new): The computer program product of claim 27, wherein during mutation, the corresponding descendant is modified by changing at least one said symbol of a chromosome corresponding to the descendant for another without disrupting the structural and functional

organization of a head and a tail of a corresponding gene producing a new descendant which is added to the population.

29. (new): The computer program product of claim 27, wherein during transposition, a corresponding descendant is modified by intra-chromosomal transposition of transposition elements randomly chosen among symbols of a head of a corresponding chromosome to a start of a randomly chosen gene of the corresponding chromosome without disrupting a structural and functional organization of said head and said tail of said chosen gene producing a new descendant which is added to the population.

30. (new): The computer program product of claim 27, wherein during insertion, a corresponding descendant is modified by intra-chromosomal insertion of insertion elements randomly chosen among symbols of a corresponding chromosome to a head of a randomly chosen gene without disrupting the structural and functional organization of said head and a tail of said chosen gene producing a new descendant which is added to the population.

31. (new): The computer program product of claim 27, wherein during gene transposition, a corresponding descendant is modified by intra-chromosomal transposition of a randomly chosen entire gene to start of a corresponding chromosome producing a new descendant which is added to the population.

32. (new): The computer program product of claim 27, wherein during one-point recombination, at least two chromosomes are randomly chosen and paired to be modified by exchanging material downstream a recombination point of the chosen chromosomes producing two new descendants which are added to the population.

33. (new): The computer program product claim 27, wherein during two-point recombination, at least two corresponding chromosomes are randomly chosen and paired to be modified by exchanging an entire gene producing two new descendants which are added to the population.

34. (new): The computer program product of claim 27, wherein said selection step further comprises a selection scheme that selects individuals according to said fitness .

35. (new): The computer program product of claim 27, further comprising a selection and replication step wherein the individual with said higher fitness is selected and replicated forming a new descendant.

36. (new): The computer program product of claim 27, wherein an individual of said population having a pre-established value of fitness is designated as the solution to the problem.

37. (new): The computer program product of claim 27, wherein the initial population of individuals is randomly generated creating chromosomes composed of one or more genes

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composed of a head containing symbols that represent functions and arguments and a tail
containing symbols representing arguments.